AMERICAN MUSEUM NOVITATES

Number 763 — Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City — Dec. 31, 1934

59, 43, 8 (935)

STUDIES ON *PAPUINA* AND *DENDROTROCHUS*, PULMONATE MOLLUSKS FROM THE SOLOMON ISLANDS

BY ILSE RENSCH

Through the good offices of Dr. E. Mayr and Mr. W. J. Eyerdam, Dr. Roy W. Miner, Curator of Living Invertebrates, of The American Museum of Natural History, New York, sent me for examination the papuinas that were gathered on the Solomon Islands by the Whitney South Sea Expedition. I have taken great pleasure and interest in studying this collection, and I take this opportunity to express my thanks to the above-mentioned gentlemen.

Altogether twenty species of *Papuina* were gathered, some of them in large series. One of these species is represented by a new race, and two species are new. I take the liberty of naming these new species after the collectors. Eighteen species have been previously recorded.

By mistake the species of *Dendrotrochus* gathered during the South Sea Expedition were also sent to Berlin. I have examined these shells because I have just received a considerable series of *Dendrotrochus* from the Museum of Basel, collected by Dr. Hediger, Dr. Bühler, and Dr. E. Paravicini.[1]

Both of these collections gave me an opportunity to clear up the whole "Rassenkreis" of *Dendrotrochus helicinoides*. This Rassenkreis represents a prototype. Six forms, which were looked upon hitherto as species, are now grouped together in a Rassenkreis because they have similar characters and replace one another geographically. Each race differs distinctly from the neighboring races but shows also considerable individual variation, often contrasting with the neighboring races. It is of great significance that there are also anatomical differences between the races. The genital systems do not differ, but the radulae show two different types. It is most interesting that even when the shells are rather similar, the radulae are quite different in some cases. For such a complex of related forms the expression "species" is insufficient, the single geographical variants being distinguished like species in the former

[1]New species established in this paper: *Papuina eyerdami, P. mayri*. New races: *P. plagiostoma bougainvilliana, Dendrotrochus helicinoides intercalata*.

sense of the word. In order to characterize the degree of phylogenetic development, the studied forms of *Dendrotrochus* would be better called a "Rassenkreis." (See B. Rensch, 1929, 'Das Prinzip geographischer Rassenkreise und das Problem der Artbildung,' Berlin.)

Papuina gamelia (Angas)

Figure 1

Geotrochus gamelia ANGAS, 1867, Proc. Zool. Soc. London, p. 888, Pl. XLIII, figs. 1–3.

Geotrochus hargreavesi ANGAS, 1869, idem, p. 625, Pl. XLVIII, fig. 2.

TYPE LOCALITY.—St. Stephen Island and Ysabel Island, Solomon Islands.

MATERIAL.—Large series from Choiseul Island (Luti, Bambatina, Lumbee, Choiseul Bay, Poro-Poro, Wurulata River). One specimen from Bougainville (Buin).

In the description of *Papuina gamelia*, Angas mentions a variety having a very broad band below, which is quite different from the small band of the typical form. The columella and the lip are colored brown instead of white. On the last three whorls there is also a small band at a distance of 1 mm. from the suture. The typical *gamelia* has this band very near the suture, so that it touches the peripheral band of the anterior whorl.

Angas, in 1869, described *Papuina hargreavesi*. This species has a similar form, the broad band below and the dark lip like the variety of *P. gamelia*, but the upper band touches the suture as does that of the typical *gamelia*. The series collected by the Whitney South Sea Expedition shows the same character. Smith[1] mentioned the great similarity of the two species. The only differences from *P. gamelia* that Smith recognizes are untenable in view of the description of the variety of *P. gamelia*. Besides, Smith emphasizes the fact that the last whorl of *P. gamelia* is not descending and the last whorl of *P. hargreavesi* is distinctly descending. But Angas writes in the description of *P. gamelia:* "the last more or less descending." The specimens of both "species" before me show the same condition.

All these attributes cause me to consider *Papuina hargreavesi* as a synonym of *P. gamelia*. Only a very large series with exact localities can show whether there is only one variety on each island or at least a large percentage of one variety. In that case it would be necessary to treat them as geographical races.

[1]1885, Proc. Zool. Soc. London, p. 591.

This surmise is founded on the large series of about 170 shells that the Whitney South Sea Expedition collected on Choiseul. All specimens possess (1) the clearer brown color of the bands (the typical *P. gamelia* has nearly black bands), (2) the band on the whorl distant 1 mm. from the suture (as in the variety of *P. gamelia*), (3) the band below never small (as in the typical *P. gamelia*), but always expanded as far as the umbilicus, being evenly brown or weakly brown-colored (as in the typical *P. hargreavesi*). The descending of the last whorl and the

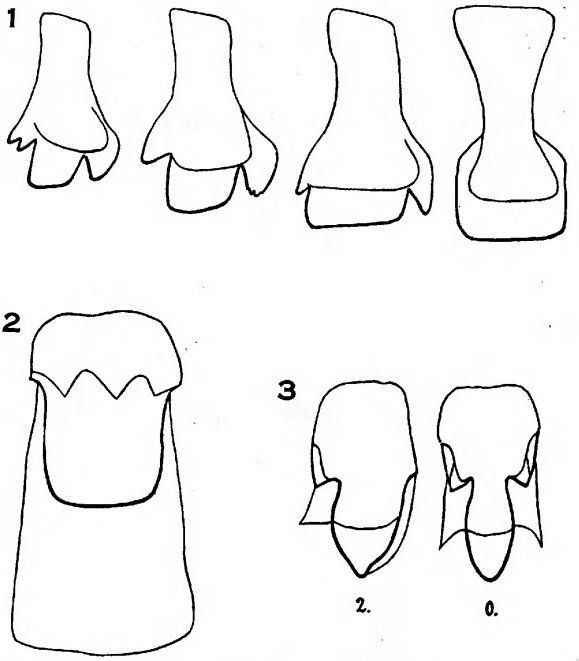


Fig. 1. Radula teeth of *Papuina gamelia* (Angas).
Fig. 2. Central tooth of the radula of *Papuina motacilla* (Pfeiffer).
Fig. 3. Radula teeth (central tooth and second tooth) of *Dendrotrochus h. helicinoides* (Hombron and Jacquinot) from Guadalcanar.

color of the lip are variable. It is remarkable that nearly all well-preserved specimens have distinct rectangular blotches near the ends of the bands which are more deeply colored and more diaphanous.

Altitude, 16.4–22.2 mm., average, 19 mm.; diameter, 18.2–23.7 mm., average 21.2 mm.

The radula (Fig. 1) shows the normal *Papuina* type of V-shaped teeth rows. Next to the central tooth, which is formed like a spatula, there follow in the middle part of the radula fifty-five teeth on each side.

These have a broad mesoconus and an entoconus. The ectoconus is generally first visible on the fourth, or even not until the eighth or tenth tooth, and then rapidly increases in size, and toward the margins it becomes double [see *P. ambrosia* (Angas)].

The reproductive organs examined in a specimen from Bougainville [collected by Hediger (Basel)], lack every accessory organ. The bursa of the receptaculum seminis is conglobate.

One specimen, collected on Bougainville, corresponds to the typical *P. gamelia*, but it differs from the large series from Choiseul. The characters of *P. gamelia* are also shown by six shells collected by Hediger (Basel), two shells from the collection of Kaltenbach (Gernrode), three shells from the Museum of Berlin, and two shells from the Museum of Leiden, all collected on Bougainville, and four on Shortland Island It is possible that the typical *P. gamelia* is generally to be found only on Bougainville and Shortland Islands.

In 1869, Angas described *Helix* (*Geotrochus*) *dampieri* from the Louisiade Islands (Proc. Zool. Soc. London, II, p. 47, Fig. 6). His figure of this species corresponds quite closely to the above-mentioned *Papuina gamelia* Angas. It is possible that there are relationships between the two forms, inasmuch as Smith, 1885, designated shells from Choiseul Island as "*P. dampieri* Ang. var.—." If this identification is correct, *Papuina dampieri smithi* C. R. Boettger from Gower Island, according to my opinion, should be regarded as a distinct species.

Papuina ambrosia (Angas)

Geotrochus ambrosia ANGAS, 1867, Proc. Zool. Soc. London, p. 889, Pl. XLIII, figs. 9–10.

Helix ramsdeni ANGAS, 1876, idem, p. 266, Pl. XXVI, figs. 6–7.

TYPE LOCALITY.—Galera or Russel Island, Solomon Islands.

MATERIAL.—Thirty-eight adult and three immature specimens, Florida Island, north of Guadalcanar; five specimens, Tulagi island, one-half mile from Florida Island; two adult and one immature specimens, Olevuga Island; one specimen, Choiseul Island.

Typical of *P. ambrosia* are bluish-white patches of various sizes, as in *Cochlostyla*. All specimens collected by the Whitney South Sea Expedition from three localities have this character. Shells of the series from Florida Island most resemble, in form and dimensions, *Papuina ramsdeni* Angas, which is considered a synonym of *Papuina ambrosia*. But *P. ramsdeni* is slenderer and has a greater altitude and generally one whorl more. Two shells from the collection of the Museum of Leiden,

also from Florida Island, show the same. On Olevuga, a small island northwest of Florida, there lives the typical *P. ambrosia*, which has the apex more obtuse and the whorls more vaulted. Five shells from Tulagi, a small island one-half mile from Florida, have the form of the typical *P. ambrosia* but not the same design. All these five shells have a brown band about 3 or 4 mm. broad above the periphery. On the penultimate whorl it becomes paler and then it disappears. Immediately below the suture there is also a small band (nearly 1 mm.), and another on the base. Typical specimens of *P. ambrosia* show only a broad band of 5 to 6 mm. on the last whorl. Two small series from the collection of the Museum at Berlin, from Russell Island (type locality of *P. ambrosia*), have the typical form and design of *P. ambrosia*, and the same is true for two specimens collected by Paravicini (Basel) on Guadalcanar (Domma, Savu).

P. ramsdeni, as just mentioned, is recognized as a synonym of *P. ambrosia*. It is possible, however, that the specimens of *P. ramsdeni* and also the specimens of *P. ambrosia* are limited geographically, because one series of thirty-eight shells from Florida Island shows the principal characters of *P. ramsdeni* (the large form), and the other series (thirty-three shells, but without locality) represents especially the typical *P. ambrosia*.

Conclusions.—Typical *P. ambrosia* is to be found principally on Russell, Olebuga, Tulagi, Guadalcanar Islands (New Georgia, see Clapp[1]); the typical *P. ramsdeni* on Florida Island, one specimen on Choiseul. It is therefore possible that the two forms are geographical races.

Altitude, 19.4–23.9 average, 21.1 mm.; diameter, 19.1–23.3, average, 20.6 mm. (*ambrosia* form). Altitude, 20.8–25.8, average, 24.9 mm.; diameter, 18.8–24.2, average, 21.9 mm. (*ramsdeni* form). The average altitude of the two forms differs by 3 mm.

The radula and the reproductive organs could be studied in one shell in alcohol, collected by Dr. E. Paravicini. The radula has the same form and the same number of teeth as *P. gamelia* (Angas). The first to fourth teeth have not a trace of an ectoconus, and I believe also that the occurrence of the ectoconus is most variable, for in only one of four radulae of *P. gamelia* studied, the first tooth after the central tooth has an ectoconus.

The reproductive organs generally resemble the figure of the genital system of *P. grata* (Michaux), copied in the 'Manual of Conchology' of Tryon and Pilsbry, IX, Pl. xii, fig. 16. There are no accessory organs.

[1]1923, Bull. Mus. Comp. Zoöl., Harvard, LXV, p. 386.

Papuina malantensis (Angas)

Helix malantensis ANGAS, 1876, Proc. Zool. Soc. London, p. 488, Pl. XLVII, figs. 1–3.

TYPE LOCALITY.—Malanta Island (Malaita), Solomon Islands.

MATERIAL.—One specimen, San Cristobal (Makira), Solomon Islands.

Papuina malantensis, described from Malaita, was collected on San Cristobal for the first time by the Whitney South Sea Expedition. Tryon and Pilsbry[1] mention the near relationship to *P. ambrosia* (Angas). But after having compared it with a large series of *P. guadalcanarensis* (Cox), collected by Dr. E. Paravicini of Basel, I believe that *P. malantensis* is still more closely related to the latter species. As I have no topotypical material from Malaita, I can compare the mentioned specimen from San Cristobal only with *P. guadalcanarensis* and *P. ambrosia*. *P. malantensis* has no patches and a greater number of bands. Because of its small form it resembles the specimens of *P. ambrosia* variety *ramsdeni*. The lip is only a little more expanded than that of *P. ambrosia*, but not so much expanded as that of *P. guadalcanarensis*. *P. malantensis* has the same small size and form, and especially as great a number of bands, as *P. guadalcanarensis*, but the latter is generally distinguished by the dark brown streak behind the expansion of the white lip and by the angled periphery.

Altitude, 25.7 mm.; diameter, 21.6 mm.

It is possible that *P. guadalcanarensis* is the geographical representative of *P. malantensis*. But *P. ambrosia* cannot be another geographical race, because Paravicini found *P. ambrosia* also at two localities on Guadalcanar.

Papuina brodiei (Brazier)

Helix brodiei BRAZIER, 1872, Proc. Zool. Soc. London, p. 20, Pl. IV, fig. 6.

TYPE LOCALITY.—Choiseul Island, Solomon Islands.

MATERIAL.—Seven adult specimens, one juvenal specimen, Choiseul Island (headlands of Wurulata River, one specimen; Tauro, six specimens).

The specimen from the Wurulata River on Choiseul corresponds to Brazier's figure and description of the variety with small, dark brown bands below and the chalk-white band above.

Altitude, 19.6 mm.; diameter, 23.9 mm.

The dimensions given by Pilsbry (*op. cit.*, p. 11) are much smaller

[1] 1891, Manual of Conchology, VII, p. 8.

than those of the specimen before me. Brazier wrote in his description, "Diam. 8 lines, alt. 7 lines." I now believe that Pilsbry has equalized 1 line to ½ inch. This would be the "old" line. But the "new" line, which was surely employed in 1872, is equal to ⅒ inch. If this is correct, the altitude of the typical shell would become 17.5 mm. and the diameter 20 mm., which would better correspond to the dimensions of the shell before me.

Six adult specimens from Tauro, the eastern part of the island, are distinguished from the specimen from the Wurulata River in form and design. The whorls are more vaulted, the last whorl is rounded on the periphery, and the apex is also somewhat blunter. The form and color of the aperture, the number of the worls (five), the lack of an umbilicus, and the dark brown, hardly expanded lip are the same. The bands show an interesting change. The chalk-white band is well preserved in only one specimen. The brown bands above, as well as those below the chalk-white band, are dissolved into a brown zigzag design, similar, for instance, to the pattern of *P. gaberti* Less. This zigzag design may be as broad as the band of the typical form or it may also cover the whole last whorl.

Altitude, 18.2–19.4 mm.; diameter, 20.2–24.9 mm.

Papuina macfarlanei (Cox)

Helix (*Geotrochus*) *marfarlanei* Cox, 1873, Proc. Zool. Soc. London, p. 567.

TYPE LOCALITY.—Solomon Islands.

MATERIAL.—Two specimens, "Bougainville"; one specimen, Kieta, Bougainville.

Papuina macfarlanei (Cox) is related to *P. coxiana* (Angas) (see this species). The differences are as follows: *P. macfarlanei* has an almost black violaceous band on the periphery. The hyaline brown blotches change more or less to a zigzag design. The shell has also a different form. The whorls are more vaulted, therefore the last whorl is rounded, whereas *P. coxiana* has flatter whorls, so that the last whorl is bluntly carinated.

Altitude, 19.4, 20.8, 21.4 mm.; diameter, 21.8, 24.4, 21.9 mm.

The three specimens from Bougainville and the typical specimen of Cox (altitude 18 mm.; diameter 23 mm.) show relations between the dimensions different than in *P. coxiana*. The diameter is always greater than the altitude, but the series of *P. coxiana* shows quite the contrary.

Up to the present day this species is known only from Bougainville

and perhaps represents a geographical race of *P. coxiana* found on Ysabel and Choiseul Islands.

Papuina coxiana (Angas)

Geotrochus coxiana ANGAS, 1867, Proc. Zool. Soc. London, p. 889, Pl. XLIII, figs. 7, 8.

TYPE LOCALITY.—Ysabel Island, Solomon Islands.

MATERIAL.—Three specimens, Choiseul Island (Luti); fifteen specimens, Choiseul Island (Tauro).

All specimens correspond well with the description of the type.

Altitude, 19.1–23 mm., average, 21.1 mm.; diameter, 17.8–22 mm., average, 20.5 mm.

Up to the present time this species was known only from Ysabel Island. It was first found on Choiseul Island by the Whitney South Sea Expedition. *Papuina macfarlanei* (Cox), which is known from Bougainville (the type locality was not mentioned by Cox) is closely related to *P. coxiana*. The most important and characteristic difference between the two species is the peripheral band of *P. macfarlanei*, which is lacking in *P. coxiana*. More material might make it possible to treat the two "species" as geographical races.

Papuina xanthochila xanthochila (Pfeiffer)

Helix xanthochila PFEIFFER, 1861, Proc. Zool. Soc. London, p. 192.

TYPE LOCALITY.—Solomon Islands.

MATERIAL.—One specimen, Bougainville Island (Buin), Solomon Islands.

In general, several series before me [thirteen specimens, Bougainville (Malmalomino) collected by Hediger (Basel); fifteen specimens, Bougainville, from the collection of the Museum of Berlin, collected by Sapper; twenty-two specimens, Bougainville, from the collection of Kaltenbach, Gernrode] do not deviate from the description. Most interesting are some specimens with differently colored aperture. In the series of the collection of Kaltenbach there is one shell which has slightly colored margins of the aperture and another one with white margins. The series collected by Sapper on Bougainville consists of seven specimens with orange-colored aperture, two with citrine-colored aperture, and six shells that are intermediately colored. A most important and interesting fact is that the shells with the orange aperture have a relatively smaller diameter of the aperture than the shells with the citrine aperture. In ten shells with orange aperture the diameter of the aperture is 52.7 per cent of the whole altitude, but in the citrine-colored

shells, 55.1 per cent. On the shells with the orange-colored aperture the expansion of the margins is generally smaller than on the citrine colored ones.

Orange-lipped specimens: altitude, 38.1–42.3 mm., average, 39.4 mm.; diameter, 24–29.7 mm., average, 27 mm.; diameter of aperture, 19.5–22 mm., average, 20.8 mm.

Citrine-lipped specimens: altitude, 40.1–47.8 mm., average, 44.5 mm.; diameter, 26.2–32.2 mm., average, 30.2 mm.; diameter of aperture, 21.4–27.4 mm., average, 24.5 mm.

DISTRIBUTION.—Bougainville, Solomon Islands (compare *Papuina xanthochila lilium* Fulton).

Papuina xanthochila lilium Fulton

Papuina lilium FULTON, 1905, Jour. of Malacology, XII (2), p. 22, Pl. VI, fig. 4.

TYPE LOCALITY.—Solomon Islands.

MATERIAL.—Twenty-four specimens Choiseul Island (Sasamanga River, nineteen; Puti, four; headland of Wurulata River, one).

One of the differences between *Papuina xanthochila* (Pfeiffer) and *P. x. lilium*, according to Fulton's opinion, is the smaller number of whorls (5½) in *P. x. lilium*. But in the large series before me there are also specimens with 6 and 6¼ whorls. The other differences (large margins of aperture, the relatively larger diameter) are pronounced.

Altitude, 41–45.6 mm.; diameter, 31.6–35.2 mm.

The radula and reproductive organs are not known.

Probably *P. x. lilium* is limited to Choiseul Island. Fulton did not mention the exact locality in his description. But shells from the collection of Fulton, which are now in the collection of the Museum of Berlin, and one shell from the collection of the Museum of Leiden have the locality "Choiseul." Smith also mentions Choiseul Island.[1]

P. x. xanthochila, generally resembling *P. x. lilium*, replaces *P. lilium* geographically on Bougainville, in my opinion. But it is not so important whether *P. lilium* is considered a sharply distinguished race of *P. xanthochila*, as I do, or a distinct species, which then must be united with *P. lilium* to an "Artenkreis" (*genus geographicum* in the sense of B. Rensch).

Papuina splendescens splendescens (Cox)

Helix splendescens COX, 1865, Proc. Zool. Soc. London, p. 696.

Helix mendana ANGAS, 1867, Proc. Zool. Soc. London, p. 889, Pl. XLIII, figs. 11, 12.

Helix brenchleyi BRAZIER, 1875, Proc. Linn. Soc. N.S. Wales, I, p. 3.

[1]1905, Ann. Mag. Nat. Hist. London, (7) XVI, p. 196.

TYPE LOCALITY.—Solomon Islands.

MATERIAL.—Seven adult specimens, Shortland Island (Faisi).

DISTRIBUTION.—Bougainville, Stephen Island, Shortland Island, Guadalcanar, Ysabel Island (?).

Papuina splendescens choiseulensis (Brazier)

Helix (*Geotrochus*) *choiseulensis* BRAZIER, 1869, Proc. Zool. Soc., London, II, p. 47, fig. 6.

MATERIAL.—One hundred specimens, Choiseul Island (Bambatana, seventy-five; Luti, ten; Tauro, eleven; Wurulata River, four; Florida Island (?), one).

Nearly all specimens of *Papuina splendescens* (Cox) that the Whitney South Sea Expedition collected on Choiseul are distinguished from the typical *P. splendescens* by the rose-colored lip and the smaller dimensions. Only those specimens have a white lip that have uncolored (hyaline) bands (of 59 specimens, 14, or 23.7 per cent, are hyaline). The form of the shell, the bands, and the umbilicus are the same. Nineteen shells from Bougainville, two from Stephen Island, two from Shortland Island (in the collection of the Museum of Berlin), seven from Shortland Island (collected by Whitney Expedition) have, in contrast to the rose-lipped form, a white lip and greater altitude. I was not sure that it would be correct to treat the specimens from Choiseul as a new geographical race, because *P. mendana* (Angas) from Ysabel Island and *P. brenchleyi* (Angas) from Guadalcanar, synonyms of *P. splendescens*, also have a white lip. The rose-lipped race would therefore be surrounded geographically by the white-lipped race. But the fact is important that Smith (1885, Proc. Zool. Soc. London, p. 591) wrote that Angas himself presented to the British Museum (Natural History) specimens of *P. mendana* from Bougainville, so that perhaps the locality "Ysabel Island" may be an error of Angas. And at least Guadalcanar must be regarded as a locality for specimens with a white lip. I believe it probable that on Choiseul Island there arose a dominant mutation with a rose lip and that it suppressed the normal variety on this island.

In studying the mollusk papers on the Solomon Islands, I have found a name that must be employed for this form: *Helix* (*Geotrochus*) *choiseulensis* Brazier. Brazier gave a colored figure, which corresponds well with the specimens before me, and he even noted that "this pretty species is intermediate in form between *Helix splendescens* Cox and *Helix mendana* Angas from the Solomon Islands."

Interesting and remarkable is the variability of the bands of both

races. The typical specimens have, besides the yellowish to chalk-white ground color (violaceous brown toward the apex), two chestnut bands which are about 2 mm. broad. The color of the bands may also be darker or lighter. Most specimens of the Tauro series have the peripheral band considerably darker than the basal and the upper bands. Cox mentions the same for the typical race. Besides, in this species the upper and the basal bands are generally so widened that only a small chalk-white band remains below the suture and below (and sometimes also above) the peripheral band. One specimen from Choiseul shows the bands covering the whole shell except a small white line near the suture.

White-lipped specimens (12) have an altitude of 26.8–30 mm., average, 28.4 mm.; a diameter of 23.7–25.5 mm., average, 24.1 mm.; rose-lipped specimens have an altitude of 21.1–30 mm., average, 24.7 mm.; and a diameter of 18.5–26 mm., average, 21.6 mm.

The radula and the genital system are not known.

Papuina meta (Pfeiffer)

Helix meta PFEIFFER, 1856, Proc. Zool. Soc. London, p. 381, Pl. XXVI, fig. 5.
Helix acmella PFEIFFER, 1860, idem, p. 135, Pl. L, fig. 4.
Helix deidamia ANGAS, 1869, idem, p. 625, Pl. XLVIII, fig. 3.
Helix miser COX, 1873, idem, p. 146.
Helix beatrix ANGAS, 1876, idem, p. 265, Pl. XX, figs. 1–5.

TYPE LOCALITY.—(Erroneously, Admiralty Islands) Solomon Islands.

MATERIAL.—Thirteen adult specimens, Choiseul Island; eight adult specimens, Florida Island; four specimens, Bougainville (Buin, two adults; Kieta, two juvenals).

The material before me shows that *Papuina meta* (Pfeiffer), *P. meta* variety *acmella* (Pfeiffer), and *P. miser* (Cox) [=*P. beatrix* (Angas)] are synonymous. Pilsbry (*op. cit.*, p. 18) also treated *P. acmella* as a synonym of *P. meta*. Though in some shells *P. acmella* differs very strongly from the typical *P. meta*, there are also intermediate specimens among the material before me. The typical *P. acmella* is higher on the average, the whorls are distinctly vaulted, and the lip is widely expanded and white. The color of the shell is yellow-greenish, on the apex whitish yellow, in contrast with the typical *P. meta* which has a different coloration, slightly vaulted whorls, and a weakly expanded dark red-brown lip. But in a series at the Museum of Berlin from Ysabel Island an intermediate specimen exists that has the clear color and the white lip of the typical *P. acmella*, but the lip is not so widely expanded and the whorls

are flat, as in the typical *P. meta*. In the collection of the Museum of Berlin there are also one similar intermediate shell from Bougainville and two intermediate specimens with the general locality Solomon Islands.

The typical *acmella* specimens are known from Bougainville, Ysabel Island (Brazier, 1880), Faro and Florida Islands (Smith, 1885), and now, collected by the Whitney South Sea Expedition, from Choiseul. The locality "Admiralty Islands" is erroneous. The typical *meta* lives on Ysabel Island [also *P. deidamia* (Angas) as a synonym] and on Bougainville. As the distribution of both "species" shows, it is thus impossible to treat them as geographical races.

P. miser (Cox) and *P. beatrix* (Angas), a synonym of *P. miser*, were described with the general locality Solomon Islands. The specimens before me called *P. miser* [four specimens from the collection of the Museum of Leiden and three from the collection of the Museum of Berlin (examples obtained by Fulton)] were found on Florida Island. The four specimens from the collection of Leiden resemble in form and color the specimens of *P. beatrix* that Angas figured (*op. cit.*). Only on his figure 5 the colors are weaker. They have small form and flat whorls like *P. meta*. Instead of the chalk-white band below the suture, one specimen has a brown band like that shown in figure 1. The other shells are unbanded. The eight specimens collected by the Whitney South Sea Expedition and three other specimens from the collection of Fulton from Florida Island are relatively larger than those of the Leiden Museum from Florida Island. They have the dimensions and some of them the vaulted whorls of *P. acmella*, but the chalk-white band of *P. meta*. Three of these shells also have a dark lip like that of *P. meta*, and the others have a white lip. Their variability shows that there are intermediate forms between *P. miser*, *P. meta*, and *P. acmella*, and I believe that all these forms are identical. Larger series would probably show that *P. miser* is a geographical race on Florida Island. This is contrary to Kobelt's[1] opinion that the yellow-colored smaller specimens with the flat whorls may represent still another species. *P. adonis* (Angas), having a different color and being acutely carinated, has nothing to do with the last mentioned form.

Meta type, altitude, 23.9–28 mm., diameter, 18.7–21.1 mm.; *acmella* type, Ysabel Island, altitude, 27.8–29.7 mm., diameter 19.9–24 mm.; *acmella* type, Choiseul Island, altitude, 27.6–29.8 mm., diameter, 21.5–24.7 mm.; *acmella* type, Bougainville, altitide, 29.6–32.6 mm., diameter,

[1] 1897, 'Conchyl. Cabinet Martini u. Chemnitz,' I, part 12, Helicorum, IV, p. 589.

23.4–24.2 mm.; Florida Island, altitude, 25.8–30.8 mm., diameter, 19.7–23.1 mm. The specimens from Bougainville (I could measure only four shells) are relatively larger than those from Ysabel and Choiseul Islands. The specimens (*meta* type) from Ysabel Island are lower.

The Whitney Expedition also collected two not completely adult shells on Bougainville (at Kieta), which are somewhat different. They have the general form of *P. meta*, but a dark brown band on the blunt carina which is not known in *P. meta*. Above and below the peripheral brown band there are chalk-white bands, of which the lower one is the broader. The incompletely finished lip is white-gray and has a little notch on the columella. But this material is too poor to be named.

Papuina plagiostoma plagiostoma (Pfeiffer)

Helix plagiostoma PFEIFFER, 1856, Proc. Zool. Soc. London, p. 381.
Papuina fulacorensis CLAPP, 1923, Bull. Mus. Comp. Zoöl., LXV, p. 389.

TYPE LOCALITY.—(Erroneously, Admiralty Islands) Solomon Islands.

The comparison shows that *P. plagiostoma* (Pfeiffer) and *P. fulacorensis* Clapp are identical. Of both species the form is generally the same. The upper whorls and the lip of *P. plagiostoma* should be dark pink, according to Pilsbry (*op. cit.*, p. 19). I can see it so only in one specimen before me. In the other specimens these parts vary in color from horn-color to white. On the paratype of *P. fulacorensis* the pink color is also slightly visible. Nearly all specimens show a more or less marked small chalk-white band below the carina. Clapp mentions the same of *P. fulacorensis*. The specimens are "unbanded, or with from one to three narrow, opaque, yellow bands, one slightly below the suture, one just above, another just below the peripheral carina."

In the description of *P. plagiostoma*, Pfeiffer gives a small altitude and a large diameter (altitude, 21; diameter 23.5 mm.) but Pilsbry gives an altitude of 26–26.5 mm. and a diameter of 21–22 mm. Clapp's *P. fulacorensis* has an altitude of 28.5 mm. and a diameter of 22.5 mm. A paratype of *P. fulacorensis* before me has an altitude of 26.6 mm. and a diameter of 22.6 mm. The shell from the collection of the Museum of Leiden measures: altitude, 27 mm., diameter, 23.3 mm.; and a specimen from the collection of the Museum of Berlin: altitude, 26.3 mm., diameter, 22.2 mm. I believe that Pfeiffer was incorrect in regard to his measurements, for in all the specimens mentioned the altitude is greater than the diameter.

Clapp figures (Fig. 32) the types of the teeth from the midlde of the radula of *P. fulacorensis*.

The original locality of *P. plagiostoma*, "Admiralty Island," which Pfeiffer gives, is an error, as Pilsbry also thinks. One of the Solomon Islands must therefore be taken as type locality. The type locality of *P. fulacorensis* is Ysabel Island. Two specimens, from the collection of Leiden, were found on the same island. This also confirms the identity of the two forms. C. R. Boettger[1] mentions the island of Buka as habitat of *P. plagiostoma*.

Papuina plagiostoma bougainvilliana, new race

TYPE LOCALITY.—Bougainville.

MATERIAL.—Four specimens, Bougainville (Harana), from the collection of the British Museum (Natural History), London; two specimens, Bougainville, collected by the Whitney South Sea Expedition.

DIAGNOSIS.—Four specimens from the collection of the British Museum, from Harana on Bougainville, are distinguished from *P. plagiostoma* Pfeiffer in having a slenderer form. The specimens have 6 or 7 whorls (*P. plagiostoma* has only 5½ or 6) and possess, like the typical race, only a half-covered umbilicus into which it is possible to look. They are quite different from *P. adonis* (Angas) and resemble this species only in the slender form. *P. adonis* has a totally covered umbilicus and a slightly expanded columella, whereas *P. plagiostoma* and its race have a broadly expanded columella. The columella of *P. adonis* forms an edge with the upper margin of the aperture, but in *P. plagiostoma* and its race this part is rounded. The specimens from Bougainville have a chalk-white band below the carina (on one shell also above the carina) and another band below the suture. Clapp's description of the bands of *P. fulacorensis* (see also *P. plagiostoma*) shows exactly the same markings. The lip is weakly expanded and horn-colored as in *P. adonis*. All the four specimens of the race are of a particularly even transparent horn color. They have a dull surface in contrast to the typical form, which is polished.

Altitude, 24.1, 25.8, 26, 27 mm.; diameter, 19.5, 19.6, 19.4, 21 mm.

I place two injured and decayed specimens collected by the Whitney Expedition on Bougainville with this race *bougainvilliana* because of the conformity of the shape, though the coloring is different. The specimens are of indistinctly dark brown-red color. The chalk-white band is found only below the carina and is lacking below the suture. The specimens are generally more solid and larger. The one nearly adult shell has 6½ whorls.

Type in the British Museum (Natural History), London (altitude, 26 mm.).

[1]1918, Abhandlungen Senck. Nat. Ges., XXXVI, p. 291.

Papuina mendoza (Brazier)

Helix (*Geotrochus*) *mendoza* BRAZIER, 1872, Proc. Zool. Soc. London, p. 21, Pl. IV, fig. 8.

TYPE LOCALITY.—Choiseul Island, Solomon Islands.

MATERIAL.—One specimen, Wurulata River; one specimen, headlands of Wurulata River, Choiseul Island.

The two specimens before me can not be distinguished from the figure and the description of Brazier. *P. mendoza* differs distinctly from *P. adonis* Angas. The apex is more pointed, the whorls and the lower side of the shell are flatter, and especially, the carina is somewhat compressed and very acute. *P. adonis* is not so sharply carinated. The aperture, also, has a different form. The spire of *P. adonis* forms a sharp edge with the basal part of the aperture, but in *P. mendoza* this part is rounded; on the other side in *P. mendoza* the barely expanded upper part of the aperture forms an edge with the basal part. *P. adonis* has this part rounded.

Altitude, 24, 24.3 mm.; diameter, 20, 18 mm.

DISTRIBUTION.—Choiseul Island.

Papuina hermione (Angas)

Helix hermione ANGAS, 1869, Proc. Zool. Soc. London, p. 625, Pl. XLVIII, fig. 5.

TYPE LOCALITY.—Bougainville.

MATERIAL.—One specimen, Bougainville (Kieta).

This one specimen is typically shaped and colored.

Altitude, 22.8 mm.; diameter, 18.7 mm.

Papuina mayri, new species

Figures 6*a*, 6*b*

MATERIAL.—Nineteen specimens, Choiseul Island, Solomon Islands.

DIAGNOSIS.—Shell with covered umbilicus, elevated trochiform, apex pointed, 5½ ot 6 vaulted whorls, the last whorl descending little or not at all in front, periphery bluntly angular, becoming rounded toward the aperture; color greenish yellow to grayish yellow, becoming whitish toward the apex, with a red-brown peripheral band nearly ½ mm. in width running in the suture on the upper whorls, which is more deeply colored near the apex, frequently becoming violaceous. On the last whorl some specimens show, more or less distinctly below the dark-colored suture, a broad chalk-white band nearly 1 mm. in width. Aperture roundly quadrangular oblique, interior of the aperture and the expanded lip white. Columella nearly vertical. Surface polished with fine growth wrinkles and very fine microscopic spiral striae on the early whorls.

Altitude 22.3–25 mm., average, 24 mm.; diameter, 20.4–22 mm., average, 21.1 mm.

This species appears to be closely related to *P. meta* (Pfeiffer), but differs in being more depressed trochiform, in having narrower whorls, a relatively greater diameter, and a small red-brown peripheral band. The ground color and also the white lip resemble *P. meta* (variety *acmella*). Like the black-lipped *P. meta*, *P. mayri* has a chalk-white band below the dark red-brown suture. But *P. meta* has this band sharply limited and brightly white in contrast to *P. mayri*. The form of the aperture and the umbilicus are not constantly different.

Type in The American Museum of Natural History (Cat. No. 62470, altitude, 23.2; diameter, 20.4 mm.).

Papuina motacilla (Pfeiffer)

Figure 2

Helix motacilla PFEIFFER, 1855, Proc. Zool. Soc. London, p. 113.

Helix lienardiana CROSSE, 1864, Jour. de Conchyl., p. 282, Pl. 1, fig. 1; 1866, idem, p. 53.

TYPE LOCALITY.—Eddystone Island, Solomon Islands.

MATERIAL.—Fourteen specimens, Malaita (Suu, eleven; Kwarambara, two; Olimburi, one); two specimens, Choiseul Island.

The specimens from the island of Malaita differ from the *P. motacilla* Pfeiffer that I have before me from New Georgia, Simbo Island (Smith, 1885), and Guadalcanar [see Dr. E. Paravicini (Basel)], in having 4¼ to 4½ whorls instead of 4½ to 5 as in *P. motacilla*. The carina is not generally so sharp and the whorls on the upper side are more convex. The shells from Malaita also are less in altitude and all have two dark chestnut bands separated by a white peripheral zone. But the bands of all the other specimens of *P. motacilla* are variable. There are shells with small brown bands and others with whitish-brown bands and a white peripheral zone, as on the typical *P. motacilla*, and a few specimens with broad dark chestnut bands. Clapp mentions (*op. cit.*, p. 394) *P. lienardiana* (=*P. motacilla*) from the island of Malaita. He remarks that the specimen from Auki has two broad chestnut bands with a white peripheral zone and that the bands are much broader than those in the specimens figured by Crosse. All specimens from Malaita correspond in this character. It is also remarkable that the margins of the aperture of the specimens from Malaita are not completely white, as in the typical *P. motacilla*, for the bands also color the margins.

It seems possible to base a geographical race on these specimens from Malaita, but unfortunately a series of *P. motacilla* with exact localities is not available to justify establishing it.

The two specimens collected by the Whitney Expedition on Choiseul do not differ from the shells of Malaita. I believe that *P. motacilla* is not known from Ysabel Island.

Altitude, 14.1–16.1 mm., average, 15 mm.; diameter, 18.5–20.3 mm., average, 19.3 mm.

Clapp figures the radula of one specimen also collected on Malaita. The radula that I prepared corresponds to this figure, but the basal plate of the central tooth shows three little points (Fig. 3). These same points are to be seen on the radula of *P. maddocksi* (Brazier), which Clapp figures. Perhaps these points characterize a special group of *Papuina*.

Pfeiffer, 1855, described *P. motacilla* with white-brown bands and a peripheral white zone. Crosse, 1864, described *P. lienardiana* with brown bands. All the other characters of the two "species" correspond. In a series before me from New Georgia there are specimens like the typical *P. lienardiana* and some like the typical *P. motacilla*, but also shells with the characters of both "species." For example, one shell has above a whitish brown band like *P. motacilla* and below a dark band like *P. lienardiana*.

Perhaps *P. sachalensis* (Pfeiffer) is also a synonym of *P. motacilla*. The similar *P. gelata* (Cox) and *P. eddystonensis* (Reeve) are well distinguished by the stronger margins of the columella.

Papuina eros (Angas)

Helix leucothoë PFEIFFER, 1861, Proc. Zool. Soc. London, p. 192.
Geotrochus eros ANGAS, 1867, Proc. Zool. Soc. London, p. 888, Pl. XLIII, figs. 4–6.

TYPE LOCALITY.—Stephen Island, Ysabel Island, Solomon Islands.

MATERIAL.—Forty specimens, Choiseul Island (Choiseul Bay, ten; Poro, two; Bambatani, eight; Tauro, thirteen; Wurulata River, five; Lumbee, two). One specimen, Faisi (Shortland Island).

Up to date, *Papuina eros* is known from Stephen Island, Ysabel Island (Clapp, *op. cit.*, p. 395), Shortland Island (Smith, 1885), and from Buka Island (C. R. Boettger, *op. cit.*, p. 294). The Whitney South Sea Expedition found *P. eros* for the first time on Choiseul Island and one shell on Bougainville [two other specimens, see Dr. Hediger (Basel)]. *P. eros* is most variable in dimensions and color, but the form is constant and very well distinguished from those species that have another design. The nearly flat whorls and especially the last whorl increase in size more rapidly. Similar species, such as *P. sachalensis* (Pfeiffer) and *P. eddystonensis* (Reeve) have a more impressed suture and therefore more convex whorls. Most of the shells have the umbilicus nearly covered by the

columella, but some other specimens are scarcely or at best half covered. *P. eros* possesses a little flattened lip which is very often pink in color.

I believe that *Papuina leucothoë* (Pfeiffer) is a synonym of *P. eros*. The specimens in this lot do not differ much from the figure in Pfeiffer's description nor from the specimens of *P. leucothoë* from the collection of the Museum of Berlin. Especially the form and the pink-colored lip are the same. Color and pattern are different. The specimens have a yellowish ground color, without bands, or with one or several more or less broad chestnut-colored bands, or with an irregular zigzag band. The apex varies in color from pink to dark violaceous, but several specimens have the apex uncolored.

The dimensions are extremely variable. The altitudes range from 11.5 to 15 mm., and the diameter from 14.5 ot 19.5 mm. The typical dimensions of *P. eros* (after Tryon and Pilsbry, *op. cit.*, p. 70) are: altitude, 14 mm., diameter, 18 mm.; of *P. leucothoë*, altitude, 12.5 mm.; diameter, 20.5 mm. Two specimens from Shortland Island, from the collection of the Museum of Leiden, have an altitude of 14.5–15 mm., and a diameter of 19.7–20.3 mm. It is remarkable that *P. leucothoë*, with such a large diameter, has such a small altitude.

Clapp figured the radula and the reproductive organs of *P. eros*.

Papuina eyerdami, new species

Figures 7*a*, 7*b*

MATERIAL.—One specimen, Choiseul Island (Puti), Solomon Islands.

DIAGNOSIS.—Shell globose trochiform, nearly bulblike; apex acute, umbilicus slightly covered; five carinated, vaulted whorls, the last descending but little; aperture rounded, lip expanded, rose-colored, columella relatively broad. The last whorls above and below dark brown with a shine of violaceous gray, the upper whorls lighter brown; directly below and above the keel is a whitish band 1 mm. broad, and the same below the suture; surface with growth wrinkles that are so strongly formed that they interrupt the keel and form knots (especially near the aperture); on the upper whorls fine spiral striae.

Altitude, 19 mm.; diameter, 21 mm.

Perhaps *Papuina caerulescens* (Angas) is most similar to the new species. *P. eyerdami* differs from it in being more rounded trochiform, nearly bulblike (caused by the vaulted last whorl), in having a very pointed protoconch and an open umbilicus. Besides, the last whorl is only slightly descending, in contrast to *P. caerulescens*. The proportion of diameter to altitude is the same in both species.

Type in The American Museum of Natural History (Cat. No. 62469).

Papuina (Crystallopsis) gowerensis fictilia (Clapp)

Crystallopsis fictilia Clapp, 1923, Bull. Mus. Comp. Zoöl., LXV, p. 397, Pl. IV, figs. 1–3.

Type Locality.—Malaita (Auki), Solomon Islands.

Material.—Fourteen specimens, Malaita (Auki).

The Whitney Expedition, and also Dr. E. Paravicini (Basel), found *Papuina gowerensis fictilia* on Malaita. The specimens generally resemble the paratype before me. The differences that Clapp described between *P. fictilia* and *P. lactiflua* (Pfeiffer) are represented only in a part of the series before me. On the average, the specimens of *P. g. fictilia* are more globose, but there are also a few shells that have an elevated apex and therefore resemble *P. lactiflua*. Looking from below into the shell, each species shows a different position of the columella. The first part of the columella of *P. lactiflua* seems to be vertical, but when looking into the aperture one can see that it is curved from back to front. In contrast to this, the columella of *P. g. fictilia* runs down obliquely sideways almost from the beginning. This difference is quite constant. The periphery is not always rounded. One shell from Auki has the periphery carinated like *P. lactiflua*. Contrary to the statement of Clapp, the suture is not less deeply impressed than in *P. lactiflua*. Some shells of *P. g. fictilia* before me have the suture even more deeply impressed and the whorls are more vaulted. Three specimens from Auki and one specimen from Buma have the white band on the periphery like *P. lactiflua*.

Altitude, 16.8–19.8 mm., average, 18.5 mm.; diameter, 23.5–27.2 mm., average, 24.9 mm. Clapp describes an altitude of 20 mm., but not one shell before me has this measure, moreover the three paratypes are smaller. The diameter also differs.

Clapp did not examine the radula and the genital system. From a shell collected by the Whitney Expedition I was able to prepare a radula. It has the normal *Papuina* type of V-shaped tooth rows. The central tooth is formed like a spatula with a curved cutting edge. The following 86–88 teeth on each side (middle part of the radula) have a large mesoconus and a little entoconus, and on the 5–6 tooth there still appears an ectoconus. Clapp figures the radula of *Crystallopsis fulacorensis* (*op. cit.*, Fig. 38); it resembles the radula of *P. g. fictilia* except that the central tooth has a more curved cutting edge. The ectoconus and the entoconus of the outermost two or three teeth of each row are bicuspid.

C. R. Boettger (*op. cit.*, p. 294) described *Papuina gowerensis* from Gower Island, north of Malaita. The paratype before me shows scarcely

any difference from *P. g. fictilia*. Therefore I believe that the two species belong to a "Rassenkreis," *P. g. gowerensis* is distinguished from *P. g. fictilia* only by the dimensions. C. R. Boettger published an altitude of 16 mm. and a diameter of 21 mm., but the paratype before me has an altitude of 17 mm. and a diameter of 23.1 mm. The average measurements of *P. fictilia* are: altitude, 18.5 mm.; diameter, 24.9 mm.

Papuina (Crystallopsis) paravicinii I. Rensch

Papuina (Crystallopsis) paravicinii I. RENSCH, 1933, Zool. Anz., CII, p. 317, fig. 5.

TYPE LOCALITY.—Malaita (Buma), Solomon Islands.

MATERIAL.—Fourteen specimens, Malaita (Suu).

The fourteen specimens collected by the Whitney Expedition near Suu, Malaita, are entirely distinct from the specimens that Dr. E. Paravicini found in Buma, Auki, and Maka (Malaita). The specimens from Suu possess small or broad indistinct chalk-white bands above and below. The aperture is more rounded and, on the average, larger than in the typical *P. paravicinii*. The lip is remarkably more expanded. These characteristics are to be observed constantly in all specimens from Suu. I surely believe that the series from Suu represents a geographical race distinct from the series from Buma and Auki. At Maka, south of Suu, Paravicini collected two specimens that resemble in general form the typical *P. paravicinii*, but with their large rounded aperture corresponding to the specimens from Suu. Perhaps they represent another race. But I will not name these races, because their limits are still indistinct.

Altitude, 14.2–17.8 mm., average, 15.8 mm.; diameter, 23–26.9 mm., average, 24.9 mm.

The radula and the genital system were described in the diagnosis of *P. paravicincii*.

"Rassenkreis" of *Dendrotrochus helicinoides*

As I have mentioned in the introduction, I would group the following species in a "Rassenkreis": *Dendrotrochus helicinoides* (Hombron and Jacquinot), *D. cleryi* (Reclus), *D. cineraceus* (Hombron and Jacquinot), *D. mentum* Hedley, *D. krämeri* Thiele, *D. filaris* Leschke, *D. labillardieri* Smith. I was able to study a very large amount of material (1160 specimens). As the Whitney Expedition collected a rather large series of *Dendrotrochus* on the Solomon Islands, I shall first examine these forms and discuss their synonymy.

Clapp, in his work (*op. cit.*, p. 375), published the list of the synonyms of *D. helicinoides: D. cineraceus, D. cleryi, Helix cyrene* Crosse, *H. quirosi* Cox, *H. zelina* Cox, etc. *Helix cineraceus* was described by Hombron and Jacquinot, 1841, in Ann. sci. nat. de Paris, p. 64. Plate VII in the volume of the 'Voyage au Pol Sud' (published about 1852) represents the figures of *D. helicinoides* and *D. cineraceus* and clearly shows the differences. *D. cineraceus* is more roundish, the whorls are more vaulted, and the aperture especially is more rounded. Series from Choiseul and Shortland Island, collected by the Whitney Expedition, show more or less distinctly these characters of *D. cineraceus* (=*D. cleryi* variety *septentrionalis* Smith, 1885, Proc. Zool. Soc. London, p. 593). At all events, the differences between these series of "*cineraceus*" are very pronounced in comparison with the specimens from San Cristobal, Ugi, St. Anna, Ulawa Islands (collection of Fulton). The large series that Dr. E. Paravicini (Basel) collected on San Cristobal (one of them contained 169 shells) shows the brown-banded type of *D. cleryi* (Reclus) [=*D. cleryi* variety *meridionalis* Smith, =*D. cyrene* Crosse from Ugi Island (the brown band is transparent)]. These forms are more conical, the whorls a little bit flatter, the upper part of the last whorl is flat in contrast to *D. cineraceus*, which has the upper part distinctly vaulted. Also the lip is a bit more expanded. The only unbanded specimens before me similar to the typical *D. helicinoides*, figured on Pl. VII, figs. 34–37 of Hombron and Jacquinot, are from Hammond Island. The type locality of this form must be St. George or Ysabel Island, which were the only islands visited by the 'Astrolabe' and the 'Zelle' (to which fact Dr. Mayr kindly called my attention). But I have no material from Ysabel Island before me.

The specimens from New Georgia, Simbo (*D. cleryi* var. *simboana* Smith), Guadalcanar, Malaita, Ysabel Island (Clapp, *op. cit.*, p. 322, Buka) are not clearly distinguishable. The series from these islands which I have before me shows that the specimens are smaller on the average and that the bands, if present, are not so sharply defined.

The other synonym, *H. quirosi* Cox, is not figured and no exact locality is published. Cox mentions the resemblance to *D. cleryi*. He writes: "This species would be like a magnified specimen of *C. cleryi* Reclus were it not wholly unornamented, much more broadly expanded and less conical." But the type is in the Sydney Museum and the comparison is not possible.

In my opinion, *Helix zelina* Cox is not a synonym of *D. helicinoides*.

H. zelina has 7 whorls, *D. helicinoides* only 5½. Also the figure given by Cox shows that *zelina* is another species.

All specimens of the whole "Rassenkreis" before me have a lattice sculpture on the embryonal whorls. The other whorls and the upper side possess a very fine and minute spiral sculpture. It is most interesting and important that banded and unbanded shells of *D. mentum* Hedley from New Britain (=Neu-Pommern) have a strong spiral sculpture. Specimens from Tabar and Mahur (east of New Ireland=Neu Mecklenburg) have the fine wavy spiral sculpture both above and below, like the shells of the Solomon Islands.

The dimensions of the various forms from the Solomon Islands are rather different:

San Cristobal—altitude, 9.8–13.7 mm., diameter, 13.8–19 mm.

St. Anna—altitude, 9–11.1 mm., diameter, 14.1–17.3 mm.

Ulawa Island, three specimens—altitude, 11.7–12.4 mm., diameter, 19.6–20.7 mm.

Choiseul Island—Altitude, 9.5–12.1 mm., diameter, 13.1–16.7 mm.

Hammond Island, two specimens—altitude, 13.2–14 mm., diameter, 14.6–16.4 mm.

Malaita—altitude, 9.5–10.7 mm., diameter, 13.2–16.7 mm.

Guadalcanar—altitude, 9.7–12.3 mm., diameter, 12.6–17.8 mm.

New Georgia—altitude, 8.1–10.7 mm., diameter, 12.5–14.7 mm.

Buka—altitude, 9.8–11 mm., diameter, 13.3–15 mm.

Ysabel Island (Clapp)—altitude, 10.7 mm., diameter, 15.4 mm.

Type of *D. helicinoides*—altitude, 10 mm., diameter, 16 mm.

As these measurements show, the rounded shells from Choiseul (*D. h. cineraceus*) do not attain the largest diameter of the *cleryi* shells. The specimens from Buka (there are only three measurable specimens before me) resemble in dimensions the specimens from Choiseul. The specimens from New Georgia average smaller.

Hedley, 1895, published (Rec. Austr. Mus., p. 90, Pl. xxi) a description and figure of the anatomy of *Dendrotrochus "helicinoidese"* without exact locality. Specimens that I examined from New Britain resemble in general Hedley's figure. They vary in the form of the duct of the spermatheca. This can be long and slender with a globose bursa, but the duct can also be swollen and big and then the bursa is not so much differentiated as Hedley's figure shows. Two specimens in alcohol from Choiseul and Guadalcanar have a long slender duct. *D. filaris* Leschke, which I was able to examine, from Lambussu and St. Matthias, collected by Dr. A. Bühler (Basel), shows the same. All specimens examined anatomically have a liver-colored gland-ring around the uterus (see the description of Hedley; he writes, "The base of the vagina is black").

It is most important and interesting that in this "Rassenkreis" there also exist anatomical differences in the radula. There are two distinct types of radula: the first is represented by the typical race *D. helicinoides cineraceus* from Choiseul, by the intermediate form from Guadalcanar (Fig. 3), and by the races *D. h. labillardieri*, *filaris*, *krämeri* (Fig. 4), and *intercalata* (compare the classification at the end of this paper); the second type is represented by the race *D. h. mentum* (Fig. 5). The first type has a more or less pointed central tooth, whereas the central tooth of *D. h. mentum* is rounded, with a little point on the middle of the cutting edge. The outer teeth of all races are bifid and very finely

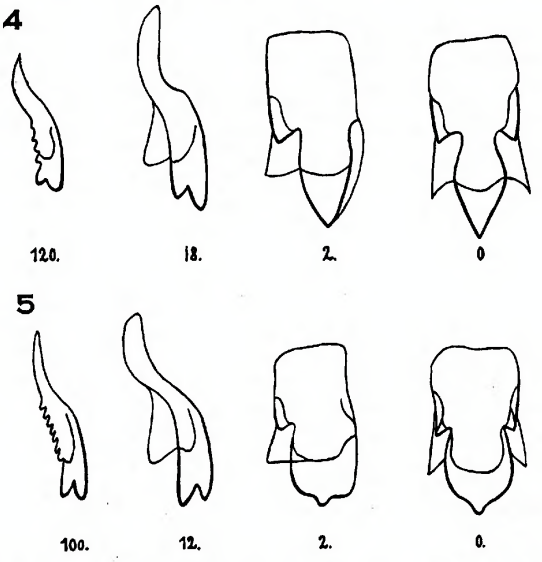


Fig. 4. Radula teeth of *Dendrotrochus helicinoides krämeri* Thiele.
Fig. 5. Radula teeth of *Dendrotrochus helicinoides mentum* Hedley.

serrated on the outside of the tooth. The outer cusp of the tooth of the specimens from New Britain is nearly always larger than the inner cusp of the tooth, in contrast to all the other races, which have a larger inner cusp. The number of teeth in half a row (nearly in the middle part of the radula) varies:

D. helicinoides cineraceus	M—(12–13)—(137–139)
D. helicinoides mentum	M—(9–10)—(110–115)
D. helicinoides filaris	M—(13–14)—(ca. 178)
D. helicinoides krämeri	M—(12–15)—(128–132)

The following list gives a detailed classification of the "Rassenkreis" of *Dendrotrochus helicinoides* based on the extensive material before me:

I.—*D. h. helicinoides* (Hombron and Jacquinot) (Fig. 8). Whitish gray to horn-yellow gray, without bands, trochiform, aperture flat, minute spiral sculpture above and below. Hammond Island. Type locality, St. George or Ysabel Island.

II.—*D. h. cineraceus* (Hombron and Jacquinot) (Figure 9). Horn to dark horn-color, without bands, globose trochiform, aperture rounded, with minute spiral sculpture. The central tooth of the radula not so sharply pointed. Choiseul and Shortland Island. (Hombron and Jacquinot gave: "New Guinea.")

III.—*D. h. cleryi* (Reclus) (Fig. 10). Same ground color as *D. h. helicinoides*, with various broad brown bands, trochiform, aperture flat, minute spiral sculpture above and below, diameter on the average larger than in the typical race. San Cristobal, St. Anna, Ugi, Ulawa, Bio Island. (Reclus gave only "Solomon Islands.")

IV.—*D. h. mentum* Hedley (=*D. acutistriatus* Leschke and *D. dahli* Thiele). Unicolored whitish to horn-colored, or with various broad brown hands, trochiform, aperture flat, with a strong spiral sculpture above and below, but there are also specimens without sculpture, dimensions smaller than in the typical race (altitude, 7.3–11.8 mm.; diameter, 9.8–15.9 mm.). The central tooth of the radula rounded with a little point on the middle of the cutting edge. Individual variability: (1) a ridge on the last whorl behind the lip, only 17.7 per cent of the 321 specimens lack this ridge (Fig. 11); (2) some specimens are strongly ribbed (*acutistriatus*) (Fig. 12). New Britain (Neu-Pommern).

V.—*D. h. krämeri* Thiele[1] (Fig. 13) (=*D. pumila* Fulton from New Ireland?). Ground color whitish, brown banded, relatively elevated, trochiform, aperture flat, minute spiral sculpture above and below, relatively great altitude (altitude 9.8 mm.; diameter, 12.4 mm.). The central tooth of the radula pointed. New Ireland (Neu Mecklenburg).

VI.—*D. h. intercalata*, new race (Fig. 14). Ground color whitish gray with various broad brown bands, trochiform, aperture flat, similar to *D. h. cleryi* but the upper side flatter, 5½ to 6 whorls, with a minute spiral sculpture above and below. In contrast to *D. h. cleryi* the shells are relatively flatter (altitude, 9–10.6 mm.; diameter, 14.1–16.1 mm.). The central tooth of the radula is pointed. TYPE No. 6029, Senck-

---

Fig. 6 *a*, *b*. The type of *Papuina mayri*, new species, Natural size.

Fig. 7 *a*, *b*. The type of *Papuina eyerdami*, new species. Natural size.

Fig. 8. *Dendrotrochus h. helicinoides* (Hombron and Jacquinot) from Hammond Island. × 2.

Fig. 9. *Dendrotrochus helicinoides cineraceus* (Hombron and Jacquinot) from Choiseul Island. × 2.

Fig. 10. *Dendrotrochus helicinoides cleryi* (Reclus) from San Cristobal. × 2.

Fig. 11. *Dendrotrochus helicinoides mentum* Hedley from New Britain. × 2.

Fig. 12. *Dendrotrochus helicinoides mentum* Hedley (*acutistriatus* Leschke) from New Britain. × 2.

Fig. 13. *Dendrotrochus helicinoides krämeri* Thiele from New Ireland. × 2.

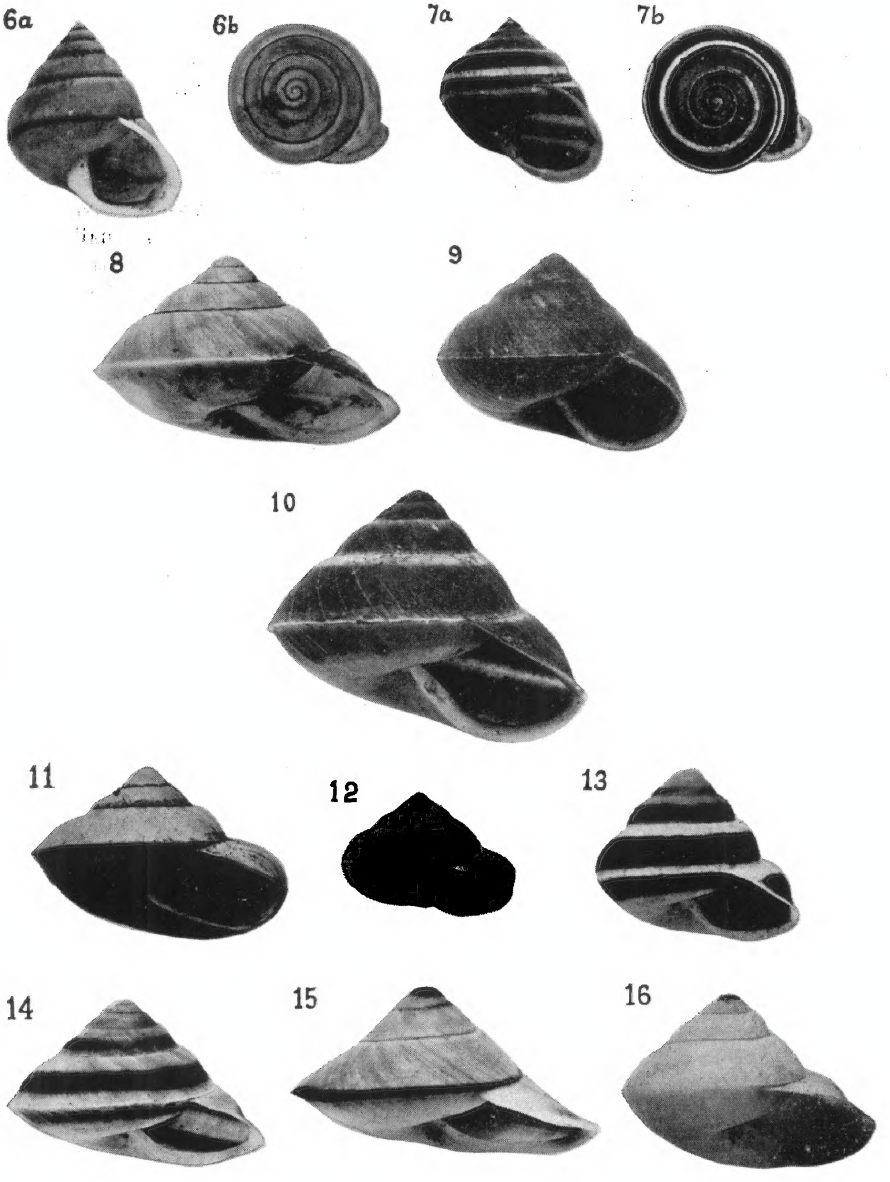
Fig. 14. *Dendrotrochus helicinoides intercalata*, new race, from Mahur. × 2.

Fig. 15. *Dendrotrochus helicinoides filaris* Leschke from St. Matthias. × 2.

Fig. 16. *Dendrotrochus helicinoides labillardieri* Smith from Admiralty Island. × 2.

---

[1]1928, Zool. Jahrb. Abt. f. System, LV, p. 132, Pl. v, fig. 19.


6a
6b
7a
7b
8
9
10
11
12
13
14
15
16

enberg. naturf. Gesell., from Mahur, a small island east of New Ireland (altitude, 10 mm.; diameter, 15.7 mm.). The specimens were kindly lent me from the collection of the Senckenberg Museum by Dr. F. Haas. Mahur, Tabar.

VII.—*D. h. filaris* Leschke,[1] (Fig. 15) (=*D. trochoidalis* Leschke, =*D. vicarius* C. R. Boetger). Unbanded whitish yellow or pink to dark violaceous, very often with a small dark violaceous band on the carina and on the suture. The apex also is often dark violaceous, elevated trochiform, whorls and upper side flat, aperture flat, lip weakly expanded, below and above a very minute spiral sculpture (altitude, 9.1–10.6 mm., diameter, 13.4–17.8 mm.; the smallest specimen of *D. filaris* Leschke, altitude, 8.4 mm.; the largest specimen of *D. vicarius* C. R. Boettger, altitude, 11 mm.). The central tooth of the radula not so sharply pointed. St. Matthias, Squally Island.

VIII.—*D. h. labillardieri* E. A. Smith[2] (Fig. 16). Unbanded, whitish gray or pink to dark violaceous, depressed globosely trochiform, whorls and upper side vaulted, aperture flat, lip very broadly expanded, apex always dark violaceous, with minute spiral sculpture above and below (altitude, 9.5–12 mm., diameter, 13–17 mm.). The central tooth of the radula a little rounded. Admiralty Islands.

[1] 1911-1912, Mitt. Nat. Mus. Hamburg, XXIX, p. 96, figs. 3, 3*a*.
[2] 1884, Proc. Zool. Soc. London, p. 264, Pl. XXII, figs. 3, 3*a*.